

June 26, 2008

Mr. Michael W. Rencheck  
Senior Vice President and  
Chief Nuclear Officer  
Indiana Michigan Power Company  
Nuclear Generation Group  
One Cook Place  
Bridgman, MI 49106

SUBJECT: DONALD C. COOK NUCLEAR PLANT, UNIT 1 (DCCNP-1) – AUTHORIZATION  
OF RELIEF REQUEST ISIR-22, ALTERNATIVE FOR THE REPAIR OF WELD  
OW-1 (TAC NO. MD8579)

Dear Mr. Rencheck:

By letter dated April 26, 2008, Indiana Michigan Power Company (I&M) proposed an alternative to the repair requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI. I&M proposed to apply a weld overlay, in accordance with ASME Code Case N-666, to degraded socket weld OW-1 of the reactor coolant system piping at Donald C. Cook Nuclear Plant Unit 1.

The Nuclear Regulatory Commission (NRC) staff has reviewed I&M's submittal and determined that compliance with the specified requirements of the ASME Code, Section XI, would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Paragraph 50.55a(a)(3)(ii), the NRC staff authorizes the use of Relief Request ISIR-22 for the installation of a weld overlay on socket weld OW-1 at the DCCNP-1. On April 26, 2008, the NRC staff provided verbal authorization of the proposed alternative. The enclosed safety evaluation documents the basis of the verbal authorization. If you have any questions, please contact Mr. Karl Feintuch at 301-415-3079.

Sincerely,

**/RA by P. Tam/**

Lois M. James, Chief  
Plant Licensing Branch III-1  
Division of Operating Reactor Licensing  
Office of Nuclear Reactor Regulation

Docket No. 50-315

Enclosure:  
Safety Evaluation

cc w/encl: See next page

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OFFICE	NRR/LPL3-1/PM	NRR/LPL3-1/LA	NRR/EMCB/BC	OGC	NRR/LPL3-1/BC
NAME	kFeintuch	THarris	TChan	KWinsberg	PTam for LJJames
DATE	6/26/08	6/13/08	6/6/08*	6/20/08	6/26/08

\*Safety evaluation transmitted by memo of 6/6/08.

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION (NRR)

RELIEF REQUEST NUMBER ISIR-22

WELD OVERLAY OF SOCKET WELD ON REACTOR COOLANT SYSTEM PIPING

INDIANA MICHIGAN POWER COMPANY

DONALD C. COOK NUCLEAR PLANT, UNIT 1 (DCCNP-1)

DOCKET NOS. 50-315

1.0 INTRODUCTION

By letter dated April 26, 2008 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML081270093), Indiana Michigan Power Company (I&M, the licensee) proposed an alternative to the repair requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI at DCCNP-1. The licensee proposed to apply a weld overlay to degraded socket weld OW-1 in the reactor coolant system piping in accordance with ASME Code Case N-666. The proposed alternative is conveyed as the licensee's Request Number ISIR-22.

The licensee requested approval of ISIR-22 by April 27, 2008. The Nuclear Regulatory Commission (NRC) staff verbally provided the authorization on April 26, 2008, in accordance with the guidance of Nuclear Reactor Regulation Office Instruction LIC-102, "Relief Request Review," Rev. 1.

2.0 REGULATORY EVALUATION

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection (ISI) of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein.

Pursuant to 10 CFR 50.55a(a)(3) alternatives to requirements may be authorized by the NRC if the licensee demonstrates that: (i) the proposed alternatives provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The code of record for the current fourth ISI interval at DCCNP-1 is the ASME Code, Section XI, 1989 edition, no addenda.

ENCLOSURE

### 3.0 TECHNICAL EVALUATION

#### 3.1 Component Affected

The affected component is socket weld OW-1 which attaches an elbow fitting to the ¾-inch reactor coolant system Class 1 piping and is located upstream of valve 1-NFP-222-V2.

#### 3.2 Applicable Code Edition and Addenda

The applicable code of record is the ASME Code, Section XI, 1989 edition, no addenda, for the fourth ISI interval. The construction code of record is the 1967 edition of ASME/American National Standards Institute (ANSI) B31.1, "Power Piping."

#### 3.3 Applicable Code Requirement

The applicable code requirement is IWA-4000 of the ASME Code, Section XI, 1989 edition, no addenda. Compliance with this code requirement would necessitate removal of the defect and replacement of the weld.

#### 3.4 Proposed Alternative and Basis for Use

The licensee's proposed alternative is application of a weld overlay in accordance with ASME Code Case N-666, "Weld Overlay of Class 1, 2, and 3 Socket Welded Connections, Section XI, Division 1." Use of this code case will restore the structural integrity of the subject socket weld by deposition of weld overlay on the outside surface of the pipe and weld. The licensee stated that no exceptions will be taken to the requirements of Code Case N-666.

#### 3.5 Duration of Proposed Alternative

The licensee stated that the duration of the proposed alternative would be the remaining service life of the component if vibration testing shows that vibration has been reduced to acceptable levels. Otherwise, the duration of the proposed alternative would be until the next Unit 1 outage, scheduled for fall 2009. Relief from the ASME code of record is requested until the NRC approves use of Code Case N-666 in a future revision of the applicable Regulatory Guide.

#### 3.6 NRC Staff Evaluation

During the DCCNP-1 heatup at the end of Refueling Outage 22 in late April 2008, the licensee discovered leakage from a through-wall defect at the toe of socket weld OW-1 in the primary coolant piping. Based on visual inspection of the leaking socket weld, the location of the defect, the configuration of piping, and the piping material (stainless steel), which precludes primary water stress-corrosion cracking, the licensee believed that the only credible mechanism for creating the defect was vibratory fatigue.

The licensee stated that the weld and piping in which the defect is located is not isolable from the reactor vessel. The elevation of the defect is below the elevation of the bottom of the reactor vessel nozzles. Repair of the defect in accordance with the applicable ASME Code, Section XI requirements would require that the reactor vessel be drained to the bottom of the reactor vessel nozzles. Since core cooling cannot be provided in this condition, the concrete missile blocks would have to be removed, the reactor vessel head studs would have to be detensioned, the reactor vessel head removed, the refueling cavity flooded, and the core defueled prior to the repair. Following the repair, the fuel would have to be reloaded, the head

reinstalled, the refueling cavity drained, the studs retensioned, and the missile blocks reinstalled. These activities would significantly delay the return of the unit to operation, resulting in hardship and unusual difficulty without a compensating increase in level of quality or safety.

The licensee proposed to use ASME Code Case N-666 to restore the structural integrity of socket weld OW-1 by deposition of weld overlay on the outside surface of the pipe and socket weld. As stated above, the licensee will not take any exceptions to Code Case N-666.

The NRC has not yet endorsed Code Case N-666 in Regulatory Guide 1.147 for generic use. However, this does not preclude the licensee from using Code Case N-666 as an alternative for the subject repair at DCCNP-1, subject to NRC approval.

The subject elbow and pipe material are shown in the following table.

Component	ASME/ASTM Designation	Size/Schedule/Rating	P #
Elbow	ASME SA-182, Grade F304	¾ inch, 6000 pounds per square inch	P-8
Pipe	ASME SA-376 Grade TP304	¾ inch, Schedule 160	P-8

The length of pipe between the elbow and the attachment to the Reactor Coolant System loop is approximately 8 inches, which is not sufficient to install a freeze seal to perform an ASME Code repair to replace the degraded socket weld. In lieu of the ASME Code repair, the licensee proposed an alternative to apply a weld overlay over the subject socket weld. The significant issues of the proposed weld overlay, as compared to the requirements of Code Case N-666, are discussed below:

Paragraph 1(b) limits the use of this code case to less than a nominal pipe size (NPS) of 2 inches and to P-No. 8 base metal. The subject socket weld is ¾ inch in diameter and is made of P-8 material. Therefore, the subject socket weld satisfies paragraph 1(b) of Code Case N-666.

Paragraph 1(c) requires that the structural portion of the overlay and seal layers shall be deposited in accordance with a Shielded Metal Arc Welding (SMAW) or Gas Tungsten Arc Welding (GTAW) Procedure Specification (WPS) qualified in accordance with IWA-4440 of the ASME Code, Section XI. The licensee stated that it has qualified procedures for either SMAW or GTAW. Therefore, the proposed alternative satisfies paragraph 1(c) of Code Case N-666.

Paragraph 1(d) requires that "...the structural overlay be performed when the system is at a temperature equal to or less than 200°F. The owner shall implement measures to prevent separation of the pipe from the fittings or flange when repairs are made with system pressure greater than 275 pounds per square inch gauge (psig). Prior to performing a repair, the owner shall verify that the pipe base material adjacent to the socket weld requiring overlay meets the required minimum wall thickness...." The licensee stated that the Reactor Coolant System pressure and temperature will be maintained less than 100 psig, and less than 170 degrees Fahrenheit during application of the overlay. The pipe wall thickness is Schedule 160 and minimum wall thickness is maintained. The NRC staff thus finds that the licensee satisfied paragraph 1(d) of Code Case N-666.

Paragraph 1(e) states that a socket weld may not be overlaid more than one time. The NRC staff finds that the one-time application requirement is necessary to limit licensees from applying repeated weld overlays onto welds without knowing the true cause of the degradation. If the installed weld overlay is degraded in the future, the licensee needs to replace the socket weld and the weld overlay in its entirety. The licensee is not taking any exception to this requirement and, therefore, has satisfied paragraph 1(e) of Code Case N-666.

Paragraph 2(a) requires that the owner verify that the socket weld failure is a result of vibration fatigue. This determination shall include review of the design, operating history, including changes in the piping system, and visual inspection of the failed socket weld. The licensee did not identify previous leaks or work on welds associated with Valve 1-NFP-222-V2 based on an electronic search of available maintenance and corrective action documents. The licensee believed that the leakage was caused by vibration and has proposed to perform tests to reduce the vibration to an acceptable level.

Paragraph 2(b) states that "...If review of the design, operating history, and changes to the piping system indicates that the current system configuration has not been changed for one or more fuel cycles, the weld overlay shall be acceptable until the next refueling outage, given that no action is taken to reduce the vibration to acceptable levels. If corrective action is taken that reduces the vibration to acceptable levels, the weld overlay shall be acceptable for the remaining life of the piping system. If the time to failure of the original socket weld was less than one fuel cycle, corrective action that reduces the vibration to acceptable levels must be taken. Vibration acceptance standards shall be in accordance with ASME-OMb-S/G-2002, Part 3..." The licensee stated that the above noted vibration testing will be performed prior to entry into Mode 1, and the licensee was not taking any exception to paragraph 2(b) of N-666. The staff, therefore, finds that the licensee satisfied paragraph 2(b) of Code Case N-666.

Paragraph 3(a) requires that the minimum throat dimension for the weld overlay is  $0.77t_n$  ( $t_n$  is the thickness of the fitting) for fittings. In Section 7 of the submittal, the licensee provided a sketch of the pipe, elbow, existing weld, overlay, and an isometric drawing marked to show the elbow with the leak. The NRC staff performed independent calculations and verified that the proposed weld overlay throat dimension satisfies the minimum throat dimension of paragraph 3(a) of Code Case N-666.

Paragraph 3(b) requires that the weld filler metal be based on American Welding Society (AWS) classification, E3XX-XX or ER3XX. The licensee stated that it will use ER308 or ER309 stainless steel for GTAW. For the SMAW, the filler metal will be E308 or E309 stainless steel. The NRC staff verified that the licensee satisfied paragraph 3(b) of Code Case N-666.

Paragraph 3(c) specifies that, if the weld overlay is applied to a socket weld without any modification to the piping system, stress analysis of the effect of the overlay is not required. If physical modifications are made to the piping system, piping stress analysis shall be evaluated. The licensee stated that the piping system will not be modified for the proposed weld overlay. Therefore, the NRC staff agrees that the licensee does not need to re-analyze the piping stress analysis.

Section 4 requires certain welding procedures for the overlay installation. Prior to welding, the licensee will visually determine the location and approximate extent of the

Cracking, as required by paragraph 4(a). Per paragraph 4(b), the licensee will peen the leak site of the subject weld. A seal weld using 309L filler material will be applied at the site of the leak. Per paragraph 4(c), the seal weld will be examined visually (VT-1) prior to performing the remaining weld overlay. Although not required by Code Case N-666, the NRC staff asked the licensee if a surface examination using liquid penetrant testing (PT) will be performed on the seal weld. The licensee elected not to perform a PT of the seal weld because the associated surface preparation would incur significant additional dose and may disturb the seal weld. The staff accepts the licensee's decision not to perform a PT of the seal weld because (1) performing PT on the seal weld would incur significant dose, (2) the weld overlay will cover the seal weld with a minimum of 2 weld passes, and (3) the weld overlay will be examined by PT.

After the seal weld is applied, the licensee will apply a minimum of two layers per paragraph 4(d) of N-666. The weld passes will use ER308L/E308L as specified in the licensee's weld manual, which is compatible with the stainless base metals. The weld passes may be also completed with ER309L/E309L filler metal, as specified in the licensee weld manual, as compatible filler material with the stainless base metals used. Based on these procedures, the NRC staff finds that the licensee has satisfied paragraphs 4(a), 4(b), 4(c), and 4(d) of Code Case N-666.

Section 5 requires visual and nondestructive examination (NDE) of the final structural weld overlay. Paragraph 5(a)(1) requires a VT-1 and NDE in accordance with the Construction Code. The licensee will perform VT-1 visual examination of the weld overlay in accordance with paragraph 5(a)(2) based on a procedure that meets the requirements of IWA-2210 of the ASME code, Section XI. The visual examination will be capable of resolving text with lower case characters (e.g., a, c, e, o) not exceeding a height of 0.044 inches at the examination distance. The maximum direct VT-1 distance will not exceed 2 feet. In addition, the licensee will examine the weld overlay using PT. The NRC staff finds that the licensee has satisfied paragraph 5(a)(1) of Code Case N-666.

Paragraphs 5(a)(3) and 5(a)(4) require NDE personnel qualification and visual examination acceptance standards, respectively. The licensee will satisfy these requirements because no exception will be taken.

Paragraph 5(b) requires the completed weld overlay be inspected to verify compliance with the criteria of paragraph 4(d) of N-666. The licensee will satisfy these requirements because no exception will be taken.

Paragraph 5(c) requires a system leakage test performed in accordance with IWA-4540. The licensee will not take exception to this requirement and therefore, paragraph 5(c) is satisfied.

In addition to Code Case N-666, the licensee has examined six other locations on the reactor coolant system for weld discrepancies. These locations were selected because they perform the same function and have similar piping configurations as the weld that is the subject of this request. The licensee stated that inspected welds were found to be defect-free and properly sized. The NRC staff finds that the licensee has expanded its sample inspection to determine the extent of the degradation among similar weld joints. The licensee's sample expansion, therefore, is acceptable.

### 3.7 NRC Staff Conclusion

The NRC staff has reviewed the licensee's submittal and determined that compliance with the specified requirements of the ASME Code, Section XI, would result in hardship or unusual difficult without a compensating increase in the level of quality and safety. The NRC staff finds further that Relief Request ISIR-22 will provide reasonable assurance of structural integrity. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the NRC staff authorizes the use of Relief Request ISIR-22 and Code Case N-666 for the installation of a weld overlay on socket weld OW-1 upstream of valve 1-NFP-222-V2 in the reactor coolant system piping at DCCNP-1. The weld overlay is authorized for the remaining service life of the component with the provision in Code Case N-666 that the vibration testing of the subject piping shows that the vibration has been reduced to acceptable levels. If vibration of the subject piping has not been reduced to acceptable levels, the weld overlay shall be acceptable until the next refueling outage, scheduled for fall 2009.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and approved in this relief request remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Reviewer: John Tsao

Date: June 26, 2008



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